Agricultural Disasters and Crop Production in Taiwan

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Abstract

Environmental variables as well as genetic factors play a key role in governing crop production. Due to the geographic and topographic characteristics and the tremendous variations in climate, agricultural disasters occur often and result in a substantial amount of economic loss every year in Taiwan. Based on a statistics from the Taiwan Agricultural Yearbooks from 1946 to 1994, data indicate that the estimated loss from agricultural disasters was more than 3.58 billion U.S. dollars. On average, it was approximately \$70 million U.S. per year. Among the categories of agricultural disasters, agricultural climatic (agro-climatic) disasters accounted for the greatest yearly loss, estimated at over 97% of the total. Six terms were assigned to agro-climatic disasters for the convenience of analysis in this paper. Accordingly, typhoon, flood, drought, low temperature, winds, and others are listed in a descending order of economic loss. It is concluded that intensive research projects dealing with these topics would benefit farmers.

Key words: Agricultural disaster, Agro-climatic disaster, Crop production, Estimated loss, Taiwan.

1. Introduction

Taiwan lies on the western Pacific, separated from the southeast coast of mainland China by the Taiwan Strait. It is located in the tropical and subtropical region, and the Tropic of Cancer lies along the center of the Province. Taiwan comprises the island proper, along with the Penghu archipelago and other islets. The total land surface is approximately 36,000 square kilometers. While about two-thirds of the area is mountains and steep slope lands, most of the agricultural activities take place on the flat lands, the remaining 29% of the total (Table 1).

The Island is characterized by warm weather, bright sunshine and abundant rainfall (Table 1). Such a diversified climate and geography makes it suitable for growing a wide range of crops and is favorable for agricultural production (Table 2). However, typhoons as well as other natural disasters frequently inflict heavy damage on crops in summer and autumn.

2. Agricultural Development

The economic as well as agricultural development in Taiwan has been very successful. The Per Capita GNP increased from \$196 U.S. in 1952 to \$11,604 U.S. in 1994 with an average growth rate of 6.78% (Fig. 1). The output gains in agriculture were achieved mainly through biotechnological innovations that increase the productivity of both labor and land.

Since the mid-1960s, the role of agriculture switched from a major supporting position

Table 1. Land and natural environment of Taiwan.

Broad land classification	Elevation (m)	Percent of total land (%)
Mountainous land	1,000~4,000	33
Slope land	100~1,000	38
Flat land	below 100	29
Region	Annual average temperature (°C)	Annual rainfall (mm)
Northern Taiwan	21.7	2,340
Central Taiwan	22.5	1,594
Southern Taiwan	23.8	1,961

(Adopted from Introduction to the Department of Agriculture and Forestry,
Taiwan Provincial Government, 1993)

Table 2. Indicators of agricultural development.

Indicator	Value (US\$ millions)						
	1952	1960	1970	1980	1990	1993	1994
Agricultural production	265	937	1,933	7,763	11,402	13,404	13,639
Percent(%)	100	354	729	2,929	4,303	5,058	5,147
Agricultural exports	114	116	388	2,251	3,361	4,194	4,843
Index	100	102	340	1,975	2,948	3,679	4,248

(Adopted from Basic Agricultural Statistics, Republic of China, 1994)

to a sustaining function of national growth (Table 3). Traditional land- and labor-intensive methods gave way to increasingly capital-intensive production. Such change arose new problems similar to those that have encountered in other industrialized countries at a comparable stage. A series of development programs have therefore been carried out to sustain agricultural growth since early 1970s. Beginning at 1992 a six-year Across-the-Board Agricultural Adjustment Program has implemented for improving agricultural management and technology.

Agricultural production in Taiwan has maintained a higher growth rate than that of population increase. The steady expansion is attributable to both the emphasis that the government has placed on agriculture and the long-term effort of farmers have paid to the farming. During the early restoration years after World War II, the agriculture in Taiwan concentrated mainly in food production, particularly rice and sugarcane. Since that time the structure of agriculture has changed swiftly. It becomes more diversified to meet market's

need. Due to the rapid development of industry and business, the percents of employment and gross domestic product of agriculture decreased when compared with other sectors (Table 3).

Table 3. Comparisons between agriculture and other sectors.

Employment	Percentage (%)						
	1952	1960	1970	1980	1990	1993	1994
Agricultural	56.1	51.0	36.7	19.5	13.0	11.5	10.9
Industry	16.9	20.0	27.9	42.5	40.8	39.1	49.4
Services	27.0	29.0	35.4	38.0	46.3	39.2	49.9
Gross domestic product (GDP)	Percentage (%)						
	1952	1960	1970	1980	1990	1993	1994
Agriculture	32.2	27.4	15.5	7.7	4.2	3.7	3.6
Industry	19.7	26.6	36.8	45.7	41.2	39.0	37.3
Services	48.1	46.0	47.7	46.6	54.6	57.3	59.1

(Adopted from Taiwan Agricultural Yearbooks, 1946-1995)

3. Agricultural and Crops Production

In the years from 1952 to 1994 agricultural production increased averagely at an annual rate of 3.8% (data not shown). However, the percent of agricultural production in Gross Domestic Product (GDP) was decreasing (Fig. 2), dropped from 29.8% from the period of 1953-1956 to 4.1% from 1989-1992. The percentage in 1994 was further decreased to 3.6%.

The general agricultural production index goes uphill, increased from 9.6 in 1946 to 100.4 in 1994 (Fig. 3, base=1991). Within its composition, fishery and livestock continued to grow since 1945, while crops reached the plateau in 1976 and forestry went downsizing after 1968. The fact can be reflected in the proportions of individual category (Fig. 4), though crops take the biggest portion in terms of production value (Fig. 5). As indicated in Fig. 6, cereals are the primary commodities of the highest production value among crops. While as aforementioned, agricultural practices in Taiwan often suffer from agricultural disasters.

4. Agricultural Disasters and Agro-climatic Disasters

According to the records of Taiwan Agricultural Yearbooks, an official publication by Tawian Provincial Government, the agricultural disasters occur every year and often impose significant amount of damage in Taiwan. The total economic loss from agricultural disasters was more than 3.58 billion U.S. dollars from 1945 to 1994 (Table 4). Among its composition, agro-climatic disasters were the major causes, occupied about 97.5% of total loss in the same period. As shown in Fig. 7 the estimated economic loss of agro-climatic disasters followed the trend of agricultural disasters, with the lowest point of 76.04% (1953) and the highest points of 100% in ten years. Others included in agricultural disasters are pests, diseases, birds, and etc..

Fig. 1. The Per Capita GNP and its growth rate in Taiwan during the period of 1952-1994. (Adopted from Basic Agricultural Statistics, Republic of China)

Fig. 2. The percent of agricultural production in Gross Domestic Product (GDP) in Taiwan from the period of 1953-1994. (Adopted from Basic Agricultural Statistics, Republic of China, 1994)

Fig. 3. Changes of agricultural production indices since 1945. (Adopted from Taiwan Agricultural Yearbooks, 1946-1995, base= 1991)

Fig. 4. The proportions of the composition of agricultural production since 1945. (Adopted from Taiwan Agricultural Yearbooks, 1946-1995)

Fig. 5. The production values of crops, forestry, fishery, and livestock since 1945. (Adopted from Taiwan Agricultural Yearbooks, 1946-1995)

Fig. 6. The production values of cereals, special crops, vegetables, and fruits in crops since 1945. (Adopted from Taiwan Agricultural Yearbooks, 1946-1995)

Table 4. The total economic loss from agricultural and agro-climatic disasters in 1945-1994.

Item	Economic loss (US\$ billion)@	Percentage (%)
Agricultural disasters	3.582	100
Agro-climatic disasters	3.491	97.46

@ US\$ 1.00 $\div$ NT\$ 27.50 (Adopted from Taiwan Agricultural Yearbooks, 1946-1995)

There are a number of categories classified in the list of agro-climatic disasters, as graphed in Fig. 8. By ranking, typhoons caused the greatest economic loss, about 2.23 billion U. S. or 63.78% of the total in 1945-1994. Damage caused by flood was second only to typhoons, nearly 704 million in total (20.16%). These are followed by drought (4.83%), low temperature (2.04%), and winds (0.66%). The occurrence frequency of typhoons was 98% (43/44) in the period from 1951-1994 (Table 5). The average yearly loss was 50.6 million with a record-high of 553.6 million in 1986 (Fig. 9). Flood damage was in the second position with an average of 14.1 million per year and a frequency of 94% (47/50). The peak for flood loss occurred in 1983 and resulted in a 139.3 million damages (data not shown). The average economic loss by drought was 3.4 million and the occurrence frequency was 64% (32/50). The maximal yearly loss was 66.2 million (1990) during the past five decades (data not shown). The occurrence frequency and year loss of low temperature and winds were 26% (13/50) and 1.4 millions and 56% (28/50) and 0.5 millions, respectively. The record-high yearly loss by low temperature was 26.3 million (1986), and by winds was 7.0 million (1989) (data not shown).

Table 5. The economic loss from various agro-climatic disasters in 1945-1994.

Category	Occurrence frequency (%)	Economic loss (US\$ million)@	
		Total	Average@@
Typhoons@@@	98	2226.5	50.6
Flood	94	703.7	14.1
Drought	64	168.7	3.4
Low temperature	26	71.1	1.4
Winds	56	23.0	0.5
Others	na		

@ US\$ 1.00 $\div$ NT\$ 27.50 (Adopted from Taiwan Agricultural Yearbooks, 1946-1995)

@@ per year

@@@ The term "typhoon" appeared officially in 1951.

na: not available

After the term "typhoon" appeared officially in 1951, it was only in 1993 that no tropical hurricane blew in Taiwan. As shown in Fig. 9, there were 24 years in which typhoon caused more than 50% loss of the damage by agro-climatic disasters.

Fig. 7. The percent of economic loss from agro-climatic disasters since 1945. (Adopted from Taiwan Agricultural Yearbooks, 1946-1995)

Classifications and proportions of agro-climatic disasters during the period of 1945-1994.

Fig. 8. Classifications and rankings of economic loss from agro-climatic disasters during the period of 1945-1994. (Adopted from Taiwan Agricultural Yearbooks, 1946-1995)

Fig. 9. The estimated economic loss from typhoons and its percentage of the agro-climatic disasters. (Adopted from Taiwan Agricultural Yearbooks, 1952-1995)

5. Concluding Remarks

Limited by natural resources, Taiwan's agriculture has relied greatly on research and technological innovations. The results have brought about increased outputs, improved breeds, and reduced losses from natural calamities. Nevertheless, the geographic and topographic characteristics and the tremendous variations in climate bring about quite a few agricultural disasters onto Taiwan. As previously analyzed, there is a substantial amount of economic loss caused by the damage from disasters, especially in terms of agro-climatic disasters, every year.

There is an old Chinese proverb saying that "human labor conquers all." To stay on the train heading toward the twenty-first century, it is necessary to take measures to strengthening agricultural science and technology development. Agricultural management should also be properly adjusted to reduce or prevent crops injuries from disasters. In that direction intensive research programs should be carried out to further understand the relations of crop-weather systems and the mechanisms of climatic factors on crop production. Farmers in Taiwan, on the other hand, have to carry on modern technology and management strategies continuously.

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